

## Patching holes in production ecosystems

*Making in America: From Innovation to Market.* By Suzanne Berger with the MIT Task Force on Production and Innovation. Cambridge, MA: The MIT Press, 2013, 222 pp., \$16.95 hardback and paperback.

Creating new products or improving existing ones requires innovation. Whether or not this innovation happens in-house, at partner institutions and government agencies, or on the production line, it requires that information about the product—and the process of creating it—flows back and forth among all players. *Making in America: From Innovation to Market*, by Suzanne Berger and the MIT Task Force on Production and Innovation, is a study of this flow of information. It examines how easily, or not so easily, innovation happens in different cultures.

Berger and her team of researchers at the Production in the Innovation Economy Commission (PIE) interviewed over 250 businesses in the United States, China, and Germany, asking them about how they bring new ideas from innovation to prototype to market. The businesses interviewed were of all sizes and structures, from corporate behemoths, to small “Main Street” operations, to technology-based startups. Instead of looking for one overarching corporate structure that fostered innovation everywhere, the PIE team focused on identifying “design principles” that reappeared in various types of businesses, using them to paint a picture of a “production ecosystem.”

The PIE production ecosystem revolves around the concept that, in taking an idea from invention to market, the production process must feed back into the innovation process to find efficiencies and to foster future invention. A healthy production ecosystem involves more than just initial innovation and production of a new good or service. It also involves public and private investment in infrastructure and in research and development (R&D); capital investment from both private and government sources; local and regional prototyping and manufacturing; and, eventually, testing and scaling to bring the product to global markets.



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Each part of this ecosystem must communicate with the other parts in order to fully realize the potential of the entire innovation-to-production process. Holes in the ecosystem of any country's industrial production process can stifle innovation and, in turn, lead to an atrophy of the businesses that previously thrived and to an underperformance of the businesses that are just starting to expand.

The researchers found that gaps in the ecosystems of some countries have potential solutions in other countries. For instance, American companies tend to innovate in the United States and to manufacture overseas. This pattern has hollowed out U.S. manufacturing, leaving fewer companies with the capacity to make prototypes or develop factory lines near the companies cultivating new ideas. Instead, products are designed and developed in-house, and final plans are sent to production facilities on the other side of the planet. Once an idea has left the hands of the designers for the factory floors, there is little room for adjusting it or modifying the production process.

At home, however, firms sometimes fail at finding businesses that can machine specific parts in prototype development or people who can code the design and functions of certain technologies before scaling a project to overseas production. Without smaller size, local manufacturers—and the institutions and workforce providing business support for them—great ideas founder at the outset. Firms are unable to gain access, physical or monetary, to larger production facilities that could make the parts or provide the technology needed for growth. Harnessing the power of global comparative advantages in such an environment may actually hinder gains in innovation that are only possible through the use of local comparative advantages.

Germany, however, has bolstered its local manufacturing sector by actively engaging universities, factories, and innovative business leaders with one another. Large German manufacturers, along with the German government, have invested in vocational schools and university programs that train for production tasks specific to their needs. The government, universities, and businesses have also partnered to fund R&D centered on those needs. In this way, the ecosystem provides future employees with skills and jobs, universities and labs with funding and relevant curricula, and businesses with labor and useful knowledge acquired through R&D.

This feedback loop, using government and universities in concert with businesses to foster innovation in the production ecosystem, has been sparsely applied in the United States, but with some success. *Making in America* outlines several examples, including a collection of biotech companies and universities in North Carolina's Research Triangle engaging in collaborative efforts, a steel manufacturer called Timken expanding its purview and working with community colleges in Ohio, and an optics engineering trade group called the Rochester Regional Photonics Cluster solving coordination problems among schools and optics companies in New York State. In each case, working together solved not only the businesses' need for skilled employees, but also their need for R&D to create new products and services or to advance existing ones. The schools benefitted by expanding their course offerings or establishing new programs, while the local labor force acquired new skills that allowed worker access to careers in businesses already in the community. The authors note that strengthening such connections among public, educational, and business entities is crucial to a thriving and inventive U.S. economy.

To foster such collaboration, the PIE team makes four suggestions. First, it suggests involving government as both the primary investor and an important ally in business objectives. The government can ease the path to opportunity and innovation, using everything from access roads to patent protections to mid-growth capital infusion. It can also be the convener of various parties in the ecosystem. Second, the trust among collective partners is essential to building a healthy production ecosystem. Defining the rules of participation, the expectations of each player, and the goals of the group may take time and cause tension, but the process is necessary for successful interactions.

Third, to avoid free riding or dominance over outcomes, all players in the ecosystem should contribute to the objectives and reap gains from the collaboration. This investment and reward design will create incentives for active participation from all involved and produce positive externalities for all parts of the ecosystem. Fourth, no one entity should dominate the resources or industrial ecosystem of a community. Only consortiums of many businesses and other institutions should be fostered by government resources in order to avoid a collapse of the system if a single large player withdraws from the market.

Adopting the four PIE suggestions can create an industrial ecosystem that is flexible enough to withstand failures and to adjust investments, skills, and focus to new innovations. This deviates from the American business objective of maximizing the bottom line of accounting spreadsheets. In fact, the authors admit that their recommendations can create positive externalities, and outside businesses, governments, and community members might be able to take advantage of a firm's investments in human capital and public-private research advances. Sharing the positive spillover may sound offputting to some firms, but the alternative is to necessarily fail at innovating, to hemorrhage skilled workers and middle-class jobs, and to miss out on future markets for goods and services.

*Making in America* will be helpful to educators trying to bridge a skills gap between what businesses need and what schools are teaching, to businesses trying to assess the best ways to grow their workforce and market share using local and regional collaboration, and to government agencies attempting to further their causes in both the local and global markets. I highly recommend it as a roadmap to reinvigorating the inventive and productive parts of American business.